NANOSCIENCE

Nanoscience is the study of extremely small things – only 10 to 100 atoms wide. It is an interdisciplinary field involving physics, chemistry, and many engineering disciplines. This specialization prepares students for careers in industry and graduate school in engineering as well as Physics.

About this Program

- **College:** Liberal Arts and Sciences (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/)
- **Degrees:** Bachelor of Arts (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BA/) | Bachelor of Science (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS/)
- **Specializations:** Medical Physics (BS) (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS03/) | Nanoscience (BS) (p. 1) | Optics (BS) (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS01/)
- **Credits for Degree:** 120
- **Contact:** Email (advising@phys.ufl.edu?Subject=Physics%20Major)
- **More Info**

To graduate with this major, students must complete all university, college, and major requirements.

Department Information

The Department of Physics is making strides toward becoming one of the premier physics departments in the United States. With active groups in astrophysics, biological physics, condensed matter/materials physics, and elementary particle physics, undergraduate and graduate students participate in cutting-edge research that prepares them for successful careers in a wide variety of fields.
Website (https://www.phys.ufl.edu/wp/)

CONTACT

Email (advising@phys.ufl.edu) 352.392.0521 (tel) | 352.392.0524 (fax)

P.O. Box 118440
2001 Museum Road
Gainesville FL 32611-8545

Curriculum

- Combination Degrees
- Physics
- Physics Minor

A physics major provides a wide range of career options. Many students pursue further studies in physics, other scientific disciplines, and various branches of engineering and medicine. Professional physicists work in universities and government laboratories seeking answers to fundamental questions about nature, in industry leading the development of new technologies, and in the medical sector performing clinical service and research. The analytical, problem-solving, and communications skills acquired by physics majors also lead to career opportunities in business and finance.

Requirements for the Major

The Physics BS specialization in Nanoscience requires a minimum of 41 credits in Physics including a specific Physics elective, 3 specific courses outside of Physics (9-11 credits), 15 credits of foundation coursework, and 13 credits of related coursework for a total of 78-80 credits. Minimum grades of C are required for coursework counted toward the major.

A minimum of 15 credits of required physics courses must be taken at UF.

Required Foundation Coursework

Code	Title	Credits
MAC 2311	Analytic Geometry and Calculus 1	4
MAC 2312	Analytic Geometry and Calculus 2	4
MAC 2313	Analytic Geometry and Calculus 3	4
MAP 2302	Elementary Differential Equations	3
Total Credits		**15**

Required Major Coursework

Code	Title	Credits
Required Major Core Courses		
PHY 2048	Physics with Calculus 1	3
or PHY 2060	Enriched Physics with Calculus 1	
PHY 2048L	Laboratory for PHY 2048	1
PHY 2049	Physics with Calculus 2	3
or PHY 2061	Enriched Physics with Calculus 2	
PHY 2049L	Laboratory for PHY 2049	1
PHY 3101	Introduction to Modern Physics	3
or PHY 3063	Enriched Modern Physics	
PHY 3221	Mechanics 1	3
or PHZ 3113	Introduction to Theoretical Physics	
PHY 3323	Electromagnetism 1	3
PHY 3513	Thermal Physics 1	3
PHY 4222	Mechanics 2	3
PHY 4324	Electromagnetism 2	3
PHY 4523	Statistical Physics	3
PHY 4604	Introductory Quantum Mechanics 1	3
PHY 4802L	Laboratory Physics 1	3
PHY 4803L	Laboratory Physics 2	3
PHZ 4404	Introduction to Solid State Physics	3
Total Credits		**41**

Required Major Courses Outside of Physics | Nanoscience

Code	Title	Credits
EEE 3396	Solid-State Electronic Devices	3
EEE 4331	Microelectronic Fabrication Technologies	3
or EMA 4614	Production of Electronic Materials	
Select one:		3-4
EEE 4222	Resonant MEMS	
EEL 4930	Special Topics in Electrical Engineering	
EGN 3353C	Fluid Mechanics	
EMA 4615	Compound Semiconductor Materials	
Total Credits		**9-10**

Related Coursework

Code	Title	Credits
CHM 2045	General Chemistry 1	3
CHM 2045L	General Chemistry Laboratory	1
CHM 2046	General Chemistry 2	3
Approved math courses beyond MAP 2302 Differential Equations [1]		6
Total Credits		**13**

[1] Certain computer science courses may substitute for one of the math electives.

Critical Tracking

Critical Tracking records each student's progress in courses that are required for progress toward each major. Please note the critical-tracking requirements below on a per-semester basis.

For degree requirements outside of the major, refer to CLAS Degree Requirements: Structure of a CLAS Degree (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/#degreerequirementstext).

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites (https://cpm.flvc.org/advance-search/) may be used for transfer students.

Semester 1

- Complete CHM 1025 or CHM 2045; or PHY 2048 or PHY 2060; and a MAC course with minimum grades of C
- 2.0 UF GPA required

Semester 2

- Complete CHM 2045/CHM 2045L and MAC 2311 with minimum grades of C
- 2.0 UF GPA required

Semester 3

- Complete CHM 2046, MAC 2312, and PHY 2048 or PHY 2060 with minimum grades of C
- 2.0 UF GPA required

Semester 4

- Complete MAC 2313; and PHY 2049 or PHY 2061 with minimum grades of C
- 2.5 critical-tracking GPA required
- 2.0 UF GPA required

Semester 5

- Complete MAP 2302 with a minimum grade of C
- Complete 2 required 3000-level physics courses with minimum grades of C (upper-division tracking)
- 2.5 critical-tracking GPA
- 2.0 UF GPA required

Semester 6

- Complete the remaining required 3000-level physics courses with minimum grades of C
- Complete 1 of 4 courses required for the Nanoscience specialization
- 2.0 UF GPA required

Semester 7

- Complete PHY 4802L or PHY 4803L
- Complete 2 required 4000-level physics courses with minimum grades of C in addition to PHY 4802L
- Complete 2 of 4 courses required for the Nanoscience specialization
- 2.0 UF GPA required

Semester 8

- Complete the remaining required 4000-level physics courses with minimum grades of C
- Complete 1 4000-level or higher physics elective with a minimum grade of C
- Complete all 4 courses required for the Nanoscience specialization
- 2.0 UF GPA required

Model Semester Plan

Students are expected to complete the Writing, Civic Literacy, summer enrollment, and Quest requirements while in the process of taking the courses below. Students are also expected to complete the General Education International (GE-N) requirements concurrently with another General Education requirement (typically, GE-C, H, or S) as part of the CLAS Basic Distribution requirements. One of the two general education mathematics courses must be a pure math course.

College of Liberal Arts and Sciences allows students additional flexibility in its Distribution Requirements. Students may count a maximum of 6 credits TOTAL from the CLAS Distribution course lists towards Humanities, Social and Behavioral Sciences, or Biological and Physical Sciences, with no more than 3 credits of Humanities, 3 credits of Social and Behavioral Sciences, or 6 credits of Biological or Physical Sciences.

The full list of major-specific requirements for this major can be found on the Overview tab. College of Liberal Arts and Sciences degree requirements can be found on the college's degree requirements page (https://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/#degreerequirementstext).

MAC 2312, MAC 2313, MAP 2302, and Approved 3000-level or higher Math electives count towards 3000 level or above electives outside of the major.

This plan is structured for students taking Calculus 1 the first semester. Students can have different schedules when they enter UF because of their backgrounds. In particular, students are encouraged to take Physics with Calculus 1 (PHY 2048 or PHY 2060) as soon as they have completed Calculus 1, even if this means delaying chemistry. For all physics courses, adequate mathematical preparation is essential and is built into the suggested plans. Physics majors should meet with a department advisor before planning their schedules.

Additional sample schedules are available on the department's website.

More Info (http://www.phys.ufl.edu/academics/undergraduate/degrees.shtml/)

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.

Course	Title	Credits
Semester One		
CHM 2045	General Chemistry 1	4
& 2045L	and General Chemistry Laboratory (**Critical Tracking**; State Core Gen Ed Physical Sciences)	
MAC 2311	Analytic Geometry and Calculus 1 (**Critical Tracking**; State Core Gen Ed Mathematics)	4
State Core Gen Ed Composition (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext); Writing Requirement		3
State Core Gen Ed Social and Behavioral Sciences (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)		3
Elective		1
	Credits	**15**
Semester Two		
Quest 1 (Gen Ed Humanities, if needed)		3
CHM 2046	General Chemistry 2 (**Critical Tracking**; Gen Ed Physical Sciences)	3
MAC 2312	Analytic Geometry and Calculus 2 (**Critical Tracking**; Gen Ed Mathematics)	4
Select one:		4
PHY 2048	Physics with Calculus 1	
& 2048L	and Laboratory for PHY 2048 (**Critical Tracking**)	
PHY 2060	Enriched Physics with Calculus 1	
& PHY 2048L	and Laboratory for PHY 2048 (**Critical Tracking**; Gen Ed Physical Sciences)	
Elective (3000 level or above, not in major)		1
	Credits	**15**
Semester Three		
Quest 2 (Gen Ed Biological Sciences OR Gen Ed Social and Behavioral Sciences, if needed)		3
MAC 2313	Analytic Geometry and Calculus 3 (**Critical Tracking**; Gen Ed Mathematics)	4
Select one:		4
PHY 2049	Physics with Calculus 2	
& 2049L	and Laboratory for PHY 2049 (**Critical Tracking**)	
PHY 2061	Enriched Physics with Calculus 2	
& PHY 2049L	and Laboratory for PHY 2049 (**Critical Tracking**; Gen Ed Physical Sciences)	
CLAS Foreign Language Proficiency Requirement [1]		4-5
	Credits	**15-16**
Semester Four		
MAP 2302	Elementary Differential Equations (**Critical Tracking**; Gen Ed Mathematics)	3
PHY 3101	Introduction to Modern Physics (**Critical Tracking**; Gen Ed Physical Sciences)	3
PHY 3221	Mechanics 1 (**Critical Tracking**; Gen Ed Physical Sciences)	3
Gen Ed Biological Sciences		3
CLAS Foreign Language Proficiency Requirement [1]		3-5
	Credits	**15-17**
Semester Five		
PHY 3323	Electromagnetism 1 (**Critical Tracking**)	3
PHY 3513	Thermal Physics 1 (**Critical Tracking**)	3
PHY 4222	Mechanics 2 (**Critical Tracking**)	3
Gen Ed Biological OR Gen Ed Social and Behavioral Sciences (area NOT taken in semester 3)		3
Elective (or CLAS Foreign Language Proficiency Requirement if 4-3-3 option) [1]		3
	Credits	**15**
Semester Six		
EEE 3396	Solid-State Electronic Devices (**Critical Tracking**)	3
PHY 4324	Electromagnetism 2 (**Critical Tracking**)	3
State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)		3
Approved Mathematics elective		3
Gen Ed Composition; Writing Requirement		3
	Credits	**15**

Semester Seven		
EEE 4331	Microelectronic Fabrication Technologies (**Critical Tracking**)	3
or EMA 4614	or Production of Electronic Materials	
PHY 4604	Introductory Quantum Mechanics 1 (**Critical Tracking**)	3
PHY 4802L	Laboratory Physics 1 (**Critical Tracking**)	3
Gen Ed Social and Behavioral Sciences		3
Approved Mathematic elective		3
	Credits	**15**
Semester Eight		
PHY 4523	Statistical Physics (**Critical Tracking**)	3
PHY 4803L	Laboratory Physics 2 (**Critical Tracking**)	3
PHZ 4404	Introduction to Solid State Physics (**Critical Tracking**)	3
Select one:		3-4
EEE 4222	Resonant MEMS (**Critical Tracking**)	
EEL 4930	Special Topics in Electrical Engineering (**Critical Tracking**)	
EGN 3353C	Fluid Mechanics (**Critical Tracking**)	
EMA 4615	Compound Semiconductor Materials (**Critical Tracking**)	
Gen Ed Humanities		3
	Credits	**15-16**
	Total Credits	**120**

[1] CLAS Foreign Language Proficiency Requirement (https://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/#degreerequirementstext)

Academic Learning Compact

The laws of Physics are the starting point for most scientific research and engineering applications. Students majoring in Physics obtain broad-based knowledge and experience applying these laws as well as hands-on experience building electronic equipment and performing experiments. Many students go on to graduate study in physics, and a considerable number pursue advanced degrees in other science disciplines, all branches of engineering and medical school. Physics majors are employed in industry doing applied work and in academia seeking the answers to fundamental questions.

Before Graduating Students Must

- Pass the UF physics field test, which consists of five parts. One part is given in each of these required courses:

Code	Title	Credits
PHY 2060	Enriched Physics with Calculus 1	3
or PHY 3221	Mechanics 1	
PHY 3323	Electromagnetism 1	3
PHY 3513	Thermal Physics 1	3
PHY 4604	Introductory Quantum Mechanics 1	3
PHY 4802L	Laboratory Physics 1	3

- Complete requirements for the baccalaureate degree, as determined by faculty.

Students in the Major Will Learn to

Student Learning Outcomes | SLOs

Content

1. Identify, define, and describe the core fields of physics: classical mechanics, electricity and magnetism, thermal physics, and quantum mechanics.
2. Identify, define, and explain experimental physics and data analysis.

Critical Thinking

3. Formulate, solve problems, and draw conclusions from data.

Communication

4. Effectively and clearly communicate ideas in speech and in writing in an accepted style.

Curriculum Map

I = Introduced; R = Reinforced; A = Assessed

Courses	SLO 1	SLO 2	SLO 3	SLO 4
PHY 2048 or PHY 2060	I		I	
PHY 2048L	I	I	I	I
PHY 2049 or PHY 2061	I		I	
PHY 2049L	I	I	I	I
PHY 3101 or PHY 3063	I, R		I, R	R
PHY 3221 or PHZ 3113	R, A		R, A	R
PHY 3323	R, A		R, A	R
PHY 3513	R, A		R, A	R
PHY 4604	R, A		R, A	R
PHY 4802L	R, A	R, A	R, A	R, A

Assessment Types

- Field test
- Report
- Presentation